

Temporal association of implementation of the Arizona Health Care Cost Containment System (AHCCCS) with changes in dental-related emergency department visits in Maricopa County from 2006 to 2012

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Abstract

Objective: To evaluate changes in emergency department (ED) dental-related visits in Maricopa County before and after the elimination of dental benefits for adult Medicaid-insured patients as of October 2010.

Methods: Hospital visits extracted from a hospital discharge dataset were used to calculate a yearly rate ratio of dental-related versus non-dental-related ED visits (as a comparison group) for adults, children, and payer types. Changes in ED visits over time were evaluated from 2006 to 2012.

Results: Overall, 1.3 percent of all ED visits (8,030,767) were for dental-related purposes. Medicaid-insured patients accounted for 41.9 percent and 44.3 percent of all dental-related ED visits in 2006 and 2012, respectively. The rate ratio for the percentage of dental-related versus non-dental-related ED visits in each age category and payer type showed little fluctuation over time indicating no evidence of change in the dental-related ED visits as a proportion of the overall number of visits due to the cuts in the dental benefits for adult Medicaid-insured patients.

Conclusion: We found no evidence that cuts in dental benefits for adult Medicaid-insured patients resulted in increased dental-related ED visits in Maricopa County during the study period. Rather, we found evidence of a shift in payer type after the 2010 policy change where dental-related ED visits by self-paid patients increased as dental-related ED visits by Medicaid-insured patients decreased. Such payer shifts will result in high uncompensated care burdens for providers and, ultimately, governmental payers.

Introduction

Dental-related visits to emergency departments (ED) are a major contributor to overall healthcare system costs in the United States. The cost of all dental-related ED visits in 2008–2010 was \$2.7 billion or \$526–\$760 per visit (1,2). Dental care provided in the ED is not only costly, but it is also a less effective than routine dental care. Dental care administered in the ED treats the immediate symptoms of an underlying problem, but it usually is not associated with follow-up or preventive care (3,4). Uninsured patients account for approximately

40 percent of all dental-related ED visits followed by Medicaid beneficiaries (30 percent) (5). Approximately 90 percent of dental-related ED visits are for patients 21 years of age or older (6).

Due in part to cost pressures, there are several recent examples where state Medicaid programs were associated with reduced or eliminated coverage for some dental services. Eliminating coverage for dental care may result in less access to private dental care and an increase in the number of patients who visit the ED. For example, dental-related ED

visits at the Boston Medical Center rose by 2 percent in the first year and 14 percent in the second year following reductions in dental coverage under the Massachusetts Medicaid program (7). Similarly, a 21 percent increase in dental-related ED visits was observed in Maryland after the 1993 elimination of Medicaid reimbursement for treatment of adults with dental emergencies (8). A study in Oregon (9,10) found increased utilization of dental services in the ED after the elimination of dental benefits from Oregon's Medicaid program. In California, the number of ED visits due to preventable conditions including dental services in 2005 to 2007 increased faster than expected based on population growth (11). The American Dental Association (ADA) noted an increase in per-capita dental-related ED visits as a percentage of overall ED visits in the United States (12-15).

The economic recession in the United States from 2007 to 2013 was associated with an increase in the number of individuals eligible for Medicaid (16) and subsequent Medicaid spending (17). Faced with declining revenues, many states made significant cuts to Medicaid. For example, in 2010 Arizona's Medicaid program – the Arizona Health Care Cost Containment System (AHCCCS) – enacted several programmatic cuts (6). These included elimination of reimbursement for dental services for adults age 21 years and older visiting emergency departments effective October 1, 2010. Concern was expressed by the Maricopa County Department of Public Health at the time that adults who lost their coverage for dental services or dental emergencies, especially those from low-income populations, might struggle to pay out-of-pocket for these services and would instead utilize the ED as an alternative to a primary provider (2). The objective of this study was to describe the pattern of dental-related ED utilization in Maricopa County, AZ, the state's most populous county, before and after implementation of the AHCCCS, with respect to patients' age and payment type.

Materials and methods

All hospital and ED visits in Arizona must be reported electronically by hospitals to the Arizona Department of Health Services (ADHS). The Maricopa County Department of Public Health maintains a Hospital Discharge Dataset (HDD) containing information on all ED visits and hospitalizations in Maricopa County. The HDD was reviewed from January 1, 2006 to December 31, 2012 and all dental-related visits were identified by using the International Classification of Diseases-9th Revision (ICD-9) diagnostic codes (Supporting Information). A visit was classified as “dental” if any of the relevant codes were included in primary or secondary diagnoses fields. All other visits that did not contain dental-related ICD-9 diagnosis codes were classified as “non-dental.” Patient age (in years) was calculated and classified as either adult (21 years or older) or child (<21 years). Expected

payer type was reported by hospitals as AHCCCS (Medicaid), Medicare, Self, or “Others” (including private insurance). Counts and percentages of dental and non-dental ED visits were calculated for each age category, by payer type, and year.

To characterize temporal trends in hospital and ED visits, a percentage (rate ratio) of dental and non-dental ED visits was calculated separately for the age of adults and children age as:

$$PR_{i,j} = \frac{\% \text{ of dental ED}_{i,j}}{\% \text{ of non-dental ED}_{i,j}}$$

Percent ratio of category i for the year j ($PR_{i,j}$): where i represents one expected payer type or age group.

%Dental ED($_{i,j}$): % of dental ED visits of category i for the year j .

Non-Dental ED($_{i,j}$): % of non-dental ED visits of category i for the year j .

A rate ratio higher than the previous year indicates an increase in the proportion of dental-related ED versus non-dental-related ED visits. A rate ratio lower than the previous year indicates a reduction in the percentage of dental-related ED visits. The rate ratio was used to compare changes in dental-related ED visits relative to changes in non-dental-related ED visits separately for adults and children, and by payer type.

A *Changepoint* program (18) in R (19) was used to identify statistically significant changes in the mean number of dental ED visits per week over time where the change point is defined as the point in time that marks a significant change in the mean of a time series. The *Changepoint* statistical package uses a general likelihood approach to test hypotheses of no change point in the time series (the null) as opposed to one or more change point(s) in the series (the alternative). Data management and analyses were performed using Stata13.1 (Stata-Corp, College Station, TX), unless otherwise specified.

Results

There were a total of 8,030,767 ED visits in Maricopa County from January 2006 to December 2012, of which 103,985 (1.3 percent) were dental-related (Table 1). Dental-related visits were predominantly by adults 21 years of age or older (65.7 percent). The percentage of dental-related ED visits by adults as opposed to children increased steadily over time from 82.0 percent in 2006 to 88.7 percent in 2012 (Table 1). Similarly, the percentage of all ED visits by adults as opposed to children increased over time from 63.8 percent in 2006 to 67.8 percent in 2012 (Table 1).

The percentage of ED visits by payer types showed different patterns. Dental-related ED visits by AHCCCS and Medicare patients increased from 41.9 and 3.8 percent in 2006 to 44.0 and 4.8 percent in 2012, respectively. Similarly, Dental-related ED visit by self-insured patients increased

Table 1 Total Visits, Percent and 95% Confidence Interval of Non-Dental ED Visits Among Adults and Children in Maricopa County from 2006 to 2012

Year	Total dental-related visits	Adults	95% CI	Children	95% CI
2006	11,280	9,257 (82.07)	81.34-82.77	2,023 (17.93)	17.23-18.66
2007	12,972	10,878 (83.86)	83.21-84.49	2,094 (16.14)	15.51-16.79
2008	13,546	11,453 (84.55)	83.93-85.15	2,093 (15.45)	14.85-16.07
2009	14,397	12,324 (85.60)	85.02-86.17	2,073 (14.40)	13.83-14.98
2010	15,531	13,332 (85.84)	85.28-86.39	2,199 (14.16)	13.61-14.72
2011	17,675	15,471 (87.53)	87.03-88.01	2,204 (12.47)	11.99-12.97
2012	18,584	16,493 (88.75)	88.29-89.20	2,091 (11.25)	10.80-11.71
Total	103,985	89,208 (85.79)	85.58-86.00	14,777 (14.21)	14.00-14.42

Year	Total non-dental ED visits	Adults	95% CI	Children	95% CI
2006	975,813	622,682 (63.81)	63.72-66.91	353,131 (36.19)	36.09-36.28
2007	1,050,396	669,213 (63.71)	63.62-63.80	381,183 (36.29)	36.20-36.38
2008	1,092,797	706,576 (64.66)	64.57-64.75	386,221 (35.34)	35.25-35.43
2009	1,147,899	729,847 (63.58)	63.49-63.67	418,052 (36.42)	36.33-36.51
2010	1,147,025	760,141 (66.27)	66.18-66.36	386,884 (33.37)	33.64-33.82
2011	1,229,129	831,284 (67.63)	67.55-67.71	397,845 (32.37)	32.29-32.45
2012	1,283,723	869,915 (67.6)	67.68-67.85	413,808 (32.23)	32.15-32.32
Total	7,926,782	5,189,658 (65.47)	65.44-65.50	2,737,124 (34.53)	34.50-34.56

from 33.4 percent in 2006, to 36.1 percent in 2012. The only group showed a decreasing percentage of visits in dental-related ED visits during this period was the “Others” which decreased from 20.5 percent in 2006 to 15.1 percent in 2012 (Table 2a).

Similar patterns were noticeable among non-dental ED visits where AHCCCS and Medicare patients increased from 2006 to 2012 and “Others” decreased over the same period (Table 2b).

Our results also showed a consistent and comparable increase in the percentage of both dental-related and non-dental ED visits throughout the study period among AHCCCS-insured adults and non-adult patients, even before the policy changes (Table 3).

The rate ratio for the percentage of dental-related to non-dental-related ED visits in each age category and payer type showed little fluctuation over time; there was no clear change in the rate ratio before versus after the policy change was implemented in 2010 (Table 4).

The *ChangePoint* analysis revealed that the mean number of adult dental-related ED visits increased consistently

throughout the study period whereas the mean number of dental-related ED visits among children fluctuated around the same mean (Figure 1). With respect to expected payer type, the mean number of dental-related ED visits was highest in 2008 for “other” payer type patients, in 2011 for AHCCCS patients, and in 2012 for self-paid patients. Interestingly, the mean number of dental-related ED visits among AHCCCS patients increased until late 2011. It then decreased, coinciding with an increase in the mean number of dental-related ED visits by self-paid patients (Figure 2).

Discussion

Previous studies in several states suggest that an increase in dental-related ED visits often follows when Medicaid programs reduce or eliminate coverage for dental services. We conducted a similar analysis following a 2010 policy change in Arizona that discontinued coverage for dental services for adults ED visits. Our study methodology accounts for rising secular trends in all ED visits and thus may present a more complete picture of the direct impact of this policy change.

Table 2a Numbers (%) of Dental-Related Emergency Department (ED) Visits in Maricopa County by Expected Payer Type from 2006 to 2012

Year	AHCCCS	95% CI	Medicare	95% CI	Others	95% CI	Self	95% CI	Total
2006	4,731 (41.9)	41.03-42.86	433 (3.8)	3.49-4.21	2,352 (20.5)	20.10-21.61	3,764 (33.4)	32.50-34.25	11,280
2007	5,380 (41.5)	40.62-42.33	478 (3.7)	3.37-4.02	2,733 (21.1)	20.37-21.78	4,381 (33.8)	32.96-34.59	12,972
2008	5,807 (42.9)	42.03-43.71	641 (4.7)	4.38-5.10	3,409 (25.2)	24.44-25.91	3,689 (27.2)	26.48-27.99	13,546
2009	7,075 (49.1)	48.32-49.96	756 (5.3)	4.89-5.63	2,542 (17.7)	17.04-18.29	4,024 (27.9)	27.22-28.69	14,397
2010	8,020 (51.6)	50.85-52.43	684 (4.4)	4.09-4.74	2,510 (16.2)	15.59-16.75	4,317 (27.8)	27.09-28.51	15,531
2011	9,343 (52.9)	52.12-53.60	804 (4.5)	4.25-4.87	2,664 (15.1)	14.55-15.61	4,864 (27.5)	26.86-28.18	17,675
2012	8,183 (44.0)	43.32-44.75	884 (4.8)	4.46-5.07	2,806 (15.1)	14.59-15.62	6,711 (36.1)	35.42-36.81	18,584
Total	48,539 (46.7)	46.38-46.98	4,680 (4.5)	4.38-4.63	19,016 (18.3)	18.05-18.52	31,750 (30.5)	30.25-30.81	103,985

Table 2b Numbers (%) of Non-Dental Emergency Department (ED) Visits in Maricopa County by Expected Payer Type from 2006 to 2012

Year	AHCCCS	95% CI	Medicare	95% CI	Others	95% CI	Self	95% CI	Total
2006	308,876 (31.6)	31.56-31.75	79,759 (8.2)	8.12-8.23	427,443 (43.8)	43.71-43.90	159,735 (16.4)	16.30-16.44	975,813
2007	337,621 (32.1)	32.05-32.23	84,807 (8.1)	8.02-8.13	464,757 (44.2)	44.15-44.34	163,211 (15.5)	15.47-15.61	1,050,396
2008	337,493 (30.9)	30.80-30.97	109,842 (10.1)	10.00-10.11	506,890 (46.4)	46.29-46.48	138,572 (12.7)	12.62-12.74	1,092,797
2009	442,638 (38.6)	38.47-38.65	115,164 (10.0)	9.98-10.09	446,052 (38.9)	38.77-38.95	144,045 (12.5)	12.49-12.61	1,147,899
2010	450,510 (39.3)	39.19-39.37	123,363 (10.8)	10.70-10.81	421,489 (36.8)	36.66-36.83	151,663 (13.2)	13.16-13.28	1,147,025
2011	470,161 (38.2)	38.17-38.34	142,056 (11.6)	11.50-11.61	449,378 (36.6)	36.48-36.65	167,534 (13.6)	13.57-13.69	1,229,129
2012	439,043 (34.2)	34.12-34.28	152,095 (11.8)	11.79-11.90	480,097 (37.4)	37.32-37.48	212,488 (16.6)	16.49-16.62	1,283,723
Total	2,786,342 (35.2)	35.12-35.18	807,086 (10.2)	10.16-10.20	3,196,106 (40.3)	40.29-40.35	1,137,248 (14.3)	14.32-14.37	7,926,782

Our analysis indicated that, while there was an increase in the total number of dental-related ED visits for the adult Medicaid population, no increase in dental-related ED visits that could be directly attributed to changes in AHCCCS cuts was found when using an appropriate comparison group. In other words, the analysis showed an increase in the number of ED dental visits by adults before and after the change in AHCCCS reimbursement policy. However, when comparing changes in dental-related ED visits by adults who were affected by the policy change versus non-adults (<21) who were not affected – and comparing the rate of change in dental-related ED visits within each group – the results showed no change over time. Therefore, there is insufficient evidence to suggest that the AHCCCS (Medicaid) policy change led to an increase in dental-related ED visits within the first 2 years.

We did see evidence of an increase in the mean number of dental-related ED visits from self-paying patients starting in late 2011, approximately the same time that the AHCCCS-insured mean number of dental-related ED visits started to

decrease. One possible explanation is that AHCCCS-insured adults who lost coverage for dental services continued to use the ED but as self-paying patients. This explanation supported by the fact that Medicaid participation among private dental providers is low (20) and there is limited access to these providers by low-income populations, especially those more likely to depend on public assistance such as AHCCCS (1,11,21-24).

Changes in Medicaid coverage with the use of adult dental services have been reported previously in Maryland (8,25), Massachusetts (7), and Oregon (9,10). The findings observed in Maricopa County are consistent with these studies reflecting an increase in the number and proportion of dental-related hospital visits by adults after the policy changes took effect. However, an increase in dental-related ED visits by adults before the policy change was enacted was also observed in Maricopa County, as well as an increase in adult ED visits for non-dental conditions both before and after the policy changed. The apparent reliance of adult AHCCCS beneficiaries on the ED for their dental care is costly and does not

Table 3 Total Visits, Percent and 95% Confidence Interval of Non-Dental ED Visits Among AHCCCS-Insured Adults and Children in Maricopa County from 2006 to 2012

Year	Total non-dental ED visits	Adults	95% CI	Children	95% CI
2006	308,876	141,973 (45.96)	45.79-46.14	166,903 (54.04)	53.86-54.21
2007	337,621	154,721 (45.83)	45.66-46.00	182,900 (54.17)	54.00-54.34
2008	337,493	160,829 (47.65)	47.49-47.82	176,664 (52.35)	52.18-52.51
2009	442,638	210,530 (47.56)	47.42-47.71	232,108 (52.44)	52.29-52.58
2010	450,510	232,375 (51.58)	51.43-51.73	218,135 (48.42)	48.27-48.57
2011	470,161	246,031 (52.33)	52.19-52.47	224,130 (47.67)	47.53-47.81
2012	439,043	208,791 (47.56)	47.41-47.70	230,252 (52.44)	52.3-52.59
Total	2,786,342	1,355,250 (48.64)	48.58-48.70	1,431,092 (51.36)	51.30-51.42
Year	Total dental-related ED visits	Adults	95% CI	Children	95% CI
2006	4,731	3,743 (79.12)	77.93-80.27	988 (20.88)	19.73-22.7
2007	5,380	4,340 (80.67)	79.59-81.72	1,040 (19.33)	18.28-20.41
2008	5,807	4,760 (81.97)	80.96-82.95	1,047 (18.03)	17.05-19.04
2009	7,075	5,907 (83.49)	82.61-84.35	1,168 (16.51)	15.65-17.39
2010	8,020	6,735 (83.98)	83.16-84.77	1,285 (16.02)	15.23-16.84
2011	9,343	8,062 (86.29)	85.58-86.98	1,281 (13.71)	13.02-14.42
2012	8,183	7,107 (86.85)	86.10-87.58	1,076 (13.15)	12.42-13.90
Total	48,539	40,654 (83.76)	83.42-84.08	7,885 (16.24)	15.92-16.58

Table 4 Rate Ratio of Dental ED Visits Compared Non-Dental ED Visits in Maricopa County from 2006 to 2012

Year	Adults	Children	AHCCCS	Medicare	Others	Self
2006	1.29	0.50	1.33	0.47	0.48	2.04
2007	1.32	0.44	1.29	0.46	0.48	2.17
2008	1.31	0.44	1.39	0.47	0.54	2.15
2009	1.35	0.40	1.27	0.52	0.45	2.23
2010	1.30	0.42	1.31	0.41	0.44	2.10
2011	1.29	0.39	1.38	0.39	0.41	2.02
2012	1.31	0.35	1.29	0.40	0.40	2.18

necessarily address the underlying causes of dental complaints. If sustained, it will likely lead to an increase in preventable oral health problems (26–28).

The main strengths of this study were inclusion of ED visits over a long period of time (7 years) and a larger sample size than previous studies. We also leveraged data from a relevant comparison group to test for differential trends in dental-related ED visits by Medicaid-insured adults who were subject to the policy change versus Medicaid-insured children who were not subject to the policy change. Finally, we analyzed payer information for all hospital visits in the largest county in Arizona that accounted for approximately 60 percent of the state's population. The longer study period and the use of internal comparison groups enabled us to account for changes in frequency of all ED visits in order to assess whether changes in dental-related ED visits could be attributed to the 2010 policy change rather than reflecting overall trends in ED visits. We concluded that a) the apparent increase in adult dental-related ED visits was proportional to

the increase in non-dental ED visits, and b) the change in the proportion of ED dental visits by payer type following the policy change was characterized by a decreased number of dental ED visits attributed to AHCCCS patients and an increase by self-paid patients. There are important policy implications related to these observations. While our study did not reveal evidence that the 2010 policy change directly resulted in differential trends in dental-related ED visits, we did note a shift in the payer mix for dental-related ED visits at Maricopa County hospitals. There may be system-wide impacts that should be addressed, given that self-paying (and uninsured) may result in high uncompensated care burdens for providers and governmental payers (29).

Changes in dental-related ED visits should be evaluated in the context of overall health care sector trends. For example, it is known that the number of ED visits in the United States has been increasing over time (24,30). Therefore, an increase in the number of ED visits for any subset of the population could be proportional to the overall increase in ED visits. Thus, using a relative measure such as the rate ratio or other appropriate measures is a more robust approach to assess the impact of a policy change on the pattern of health care delivery in a population subset. Neely *et al.* concluded that the Massachusetts Health Care Reform implemented July 1, 2010 resulted in a 2 percent and a 10 percent increase in adult dental ED visits to Boston General Hospital 1 and 2 years after a policy change, respectively (7). They compared the mean number of dental ED visits for a 3-year period of time prior to the policy changes to the number of ED visits in the same hospital for 2 years following the policy change. Cohen *et al.*

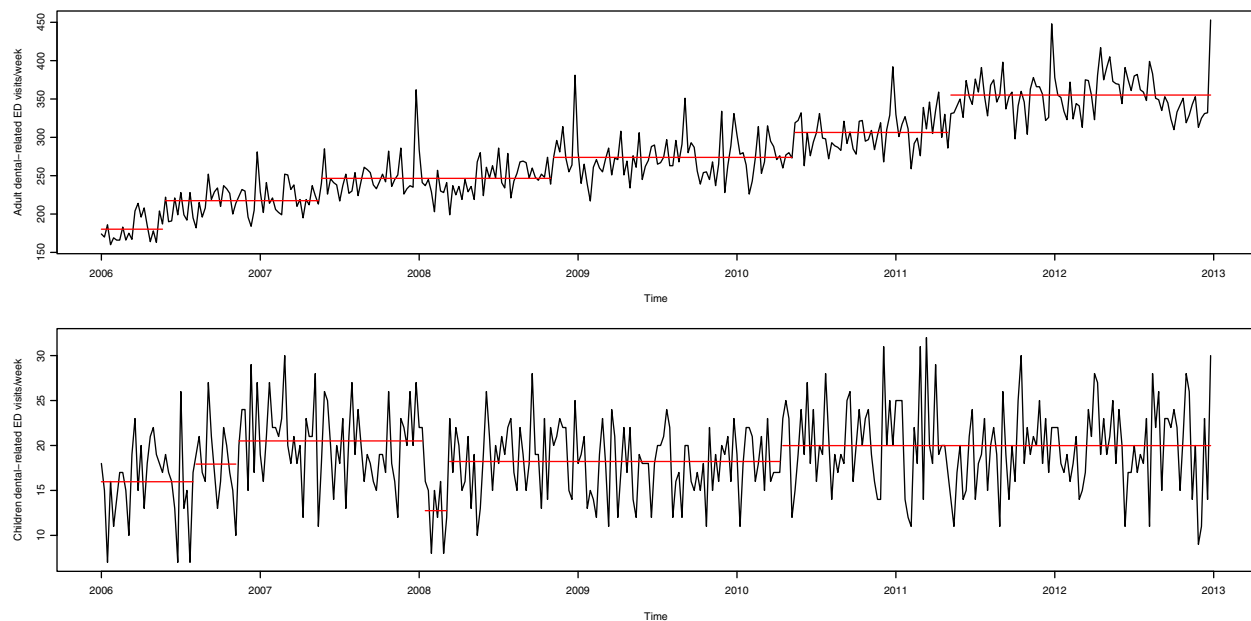


Figure 1 Change point in the mean number of dental-related ED visits in Maricopa County in adults versus children. [Color figure can be viewed at wileyonlinelibrary.com]

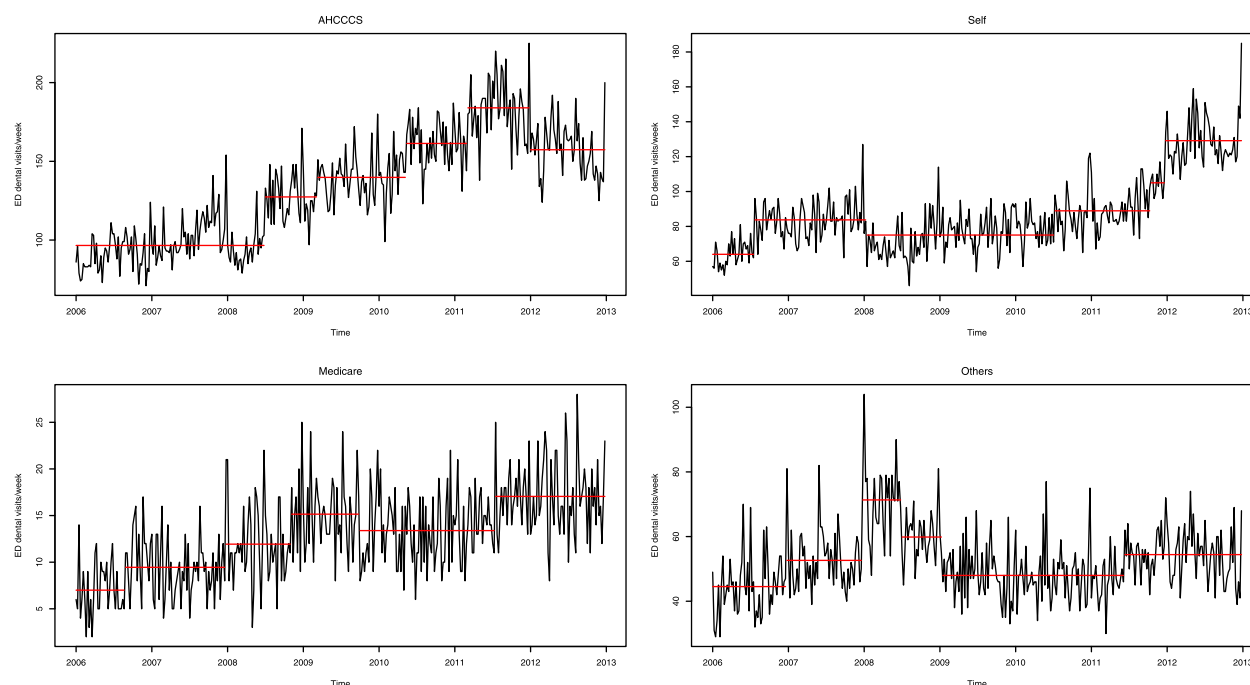


Figure 2 Change point in the mean number of dental-related ED visits in Maricopa County by expected payer type. [Color figure can be viewed at wileyonlinelibrary.com]

examined the effect of Medicaid cuts on adult dental ED visits to University of Maryland's Hospital in Baltimore (8). They compared the percentage of dental ED visits to this hospital before and after the policy changes and reported an increase of 11 percent and 21 percent, respectively among non-Medicaid and Medicaid patients. They also reported an increase of 13.9 percent in all ED visit during the same time period. It is difficult to assess whether the increase in dental ED visits reported in the Massachusetts study was interpreted correctly, since the total number of hospital visits for the same time period was not given. In the Maryland study, it is possible that the increase in Medicaid and non-Medicaid dental ED visits was proportional to the increase in overall visits.

One limitation of the present study is that the expected payer type recorded during a patient's visit may not necessarily reflect the actual payer. Claims data, including the amount of reimbursement requested and submitted to AHCCCS, may be denied or only approved for partial payment. Also, the pattern of dental-related ED visits in Maricopa County may not be generalizable to other geographic areas with different demographics. Another limitation is that while the observed increase in self-paid patients coincided with a health care policy change, it is not known whether the loss of private insurance resulted from unemployment and or other factors associated with the recession.

In conclusion, an increase in the number of adult dental-related ED visits occurred in Maricopa County, Arizona from 2006 to 2012 in proportion to an increase of non-dental-

related ED visits during the same time period. We found no evidence that elimination of AHCCCS reimbursement for adult dental ED visits resulted in increased number dental ED visits as previously reported in other parts of the country. Unfortunately, elimination of AHCCCS coverage of adult ED dental visits, even in the absence of evidence that it did not lead to an increase in ED dental visits, may still have system-wide impacts including high uncompensated care burdens for providers and, ultimately, governmental payers.

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SUPPORTING INFORMATION

Additional Supporting Information may be found online in the supporting information tab for this article.